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An Integrating Anemometer

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1882 Proc. Phys. Soc. London 5 157

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XVI. *An Integrating Anemometer.* By WALTER BAILY*.

[Plate VII.]

THE object of the instrument described in this paper is to resolve the velocity of the wind in two directions at right angles to one another, and to obtain the time-integral of each part separately.

The instrument contains a horizontal plane, in which are two slits N S and E W, forming a cross to be placed with its arms towards the cardinal points. In these slits are sliders F, G, connected by a bar of constant length. O is the centre of the cross, H the centre of the bar. The locus of H is a circle with centre O. A weathercock or some equivalent mechanism is to keep H in such a position that the radius O H is in the direction of the wind. The sliders carry beneath them wheels, B, C, whose planes are perpendicular to their respective slits, and whose centres are beneath the pivots joining the slits to the bar. [See figs. 1, 2, 3, Plate VII. Fig. 1 gives a perspective view of the instrument, omitting some points; fig. 2 gives a view of the top of the instrument; and fig. 3 gives a section of a slit and slider, and shows the wheel carried by the slider.] The wheels B, C rest on a disk, A (fig. 1), which revolves about a vertical axis immediately below O. The disk A is to be rotated by Robinson's cups, or some equivalent mechanism, so as to have a velocity proportional to that of the wind. The pieces which carry the wheels B, C should be allowed some play in a vertical direction; and the contact of B and C with A can then be maintained either by their own weight or by the use of a spring. The number of rotations of B in a given time is proportional to the time-integral of the resolved part of the wind in one direction (say, north); and the number of rotations of C is proportional to the time-integral of the resolved part of the wind in a direction at right angles to the first (say, west).

Let Ω be the angular velocity of the disk A; ω, ω' the angular velocities of the wheels B, C; m, m' the number of their rotations in a given time t; b their radius, a the length of the bar; θ the angle between the direction of the wind and

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* Read June 10, 1882.

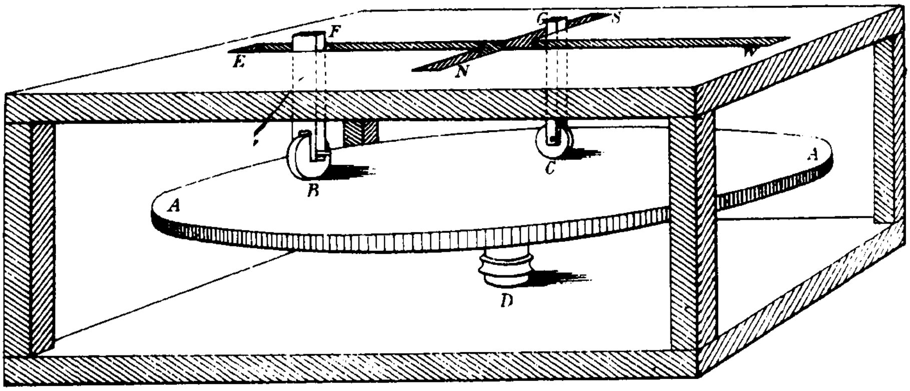

Fig: 1.

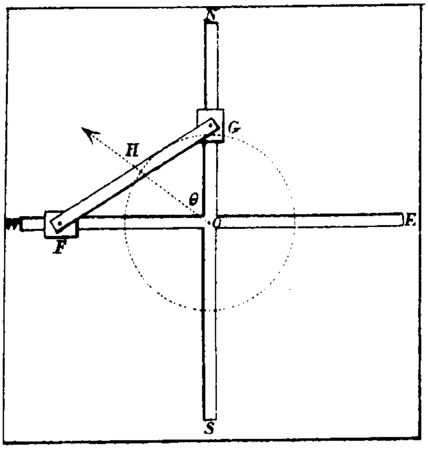

Fig: 2.

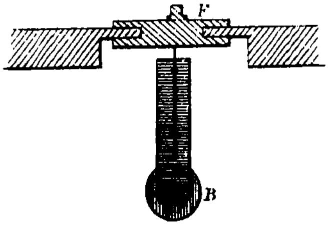

Fig: 3.

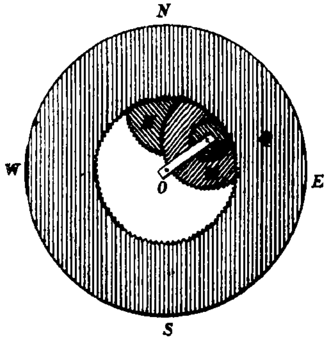

Fig: 4.

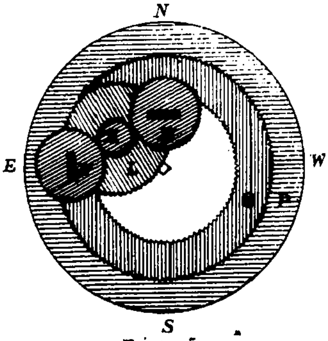

Fig: 5.

Mintern Bros lith.

(say) the north; then $b\omega = a \sin\theta \, . \, \Omega$, and $b\omega' = a\cos\theta \, . \, \Omega$; and the integrals required are

$$\int_0^t \Omega \sin\theta \, dt = \int_0^t \frac{b}{a} \omega \, dt = \frac{b}{a} \pi m$$

and

$$\int_0^t \Omega \cos\theta \, dt = \int_0^t \frac{b}{a} \omega' dt = \frac{b}{a} \pi m'.$$

Therefore m, m' are proportional to the required integrals.

Each slider might carry a train of wheels to record the number of rotations; or an electrical arrangement might be made in which each wheel should complete a circuit at each rotation and the number of contacts should be recorded. In the latter case, as no distinction is preserved as to the direction in which the wheels revolve, it becomes necessary to have four circuits, one for each cardinal point, with a recorder in each, and to have one connected with each arm of the cross.

A working model of the instrument above described was exhibited at the Meeting, and was fitted with an electrical arrangement such as I have mentioned.

I have since discovered that the slits, sliders, and bar above described may be replaced by a train of cogged wheels. (Fig. 4 represents the upper, and fig. 5 the under surface of the train.) A bar turns in a horizontal plane about O, and is kept in the direction of the wind. This bar carries three wheels, H, K, L, having the same axis. The length of the bar from one pivot to the other is supposed to be an inch and a half. The wheels H, K are rigidly connected; and L lies between them and turns independently. H and K are 1 inch, and L is 3 inches in diameter. L rolls on the inner edge of P, and H rolls on the inner edge of Q, the diameters of P and Q being 6 and 4 inches respectively. Two wheels, M and N, whose diameters are 2 inches, are carried by the wheel L, and have their centres at the extremities of a diameter of L. M and N are in the same plane as K, and are therefore touched by it. As the bar rotates, M and N move without rotation, and their centres move in straight lines passing through O at right angles to one another, and are at a fixed distance apart, and have the line joining them bisected by the bar, which is the direction of the wind. Hence M and N may be used to carry the wheels B, C (fig. 1) instead of their being carried by the sliders F and G.